sissippi Valley and Lake region, after which it passed south over the Ohio Valley and Tennessee to central Georgia, from which point it moved north, following the general direction of the coast line from Georgia to Massachusetts. The northeasterly movement of this storm was attended by heavy rains and dangerous gales along the coast. The pressure decreased at the centre of disturbance during its passage over the south and middle Atlantic states, and the storm apparently attained its maximum energy while passing from Virginia to New York. After reaching New England its course apparently changed to the east, and it disappeared on the 29th.

X.—Was central north of Washington on the 27th and moved directly eastward during the 28th and 29th, reaching Manitoba on the latter date, where it disappeared, unattended by any marked change in weather conditions within the limits of the United States.

XI.—This storm apparently developed on the south and east slopes of the Rocky Mountains, and was probably central in east New Mexico on the 27th. It remained almost stationary in this region during the succeeding forty-eight hours, after which it moved slowly to the northeast, passing over the central Mississippi valley during the 30th, causing general rains over the winter wheat states, where rain was much needed, and doubtless improved the condition of that crop. This disturbance could not be traced farther than the southern portion of Michigan, where it was central on the morning of the 1st. The previous reports indicated that the barometric pressure was increasing at the centre, and no trace of this disturbance remained on the afternoon chart of the 31st.

XII.—As in the preceding case, this disturbance apparently developed in eastern New Mexico. It moved southeasterly towards the Texas coast, where it remained at the close of the month. The succeeding history of this storm will be given in the November REVIEW.

The following tables exhibit some of the principal facts regarding these low areas:

TABLE I.

| No. | First observed. Date. | First observed. Lat. N. | First observed. Long. W. | Last observed. Lat. N. | Last observed. Long. W. | Duration. | Velocity per hr. | Lowest pressure. Date. | Lowest pressure. Station. | Lowest pressure. Reading. |
|---|---|---|---|---|---|---|---|---|---|---|
| | | ° | ° | ° | ° | Days. | Miles. | | | Inches. |
| I..... | 1 | 48 | 76 | 49 | 63 | 1.5 | 20.0 | 1 | Father Point, Quebec .. | 29.38 |
| II..... | 1 | 50 | 116 | 47 | 69 | 3.0 | 33.0 | 1 | Swift Current, N. W. T. | 29.52 |
| III..... | 3 | 51 | 111 | 51 | 67 | 4.5 | 28.0 | 7 | Nantucket, Mass ..... | 29.50 |
| IV..... | 7 | 46 | 126 | 53 | 101 | 3.0 | 20.0 | 7 | Portland, Oregon ..... | 29.50 |
| V..... | 11 | 43 | 90 | 39 | 70 | 1.5 | 33.0 | 12 | Baltimore, Md ..... | 29.84 |
| VI..... | 12 | 37 | 121 | 52 | 60 | 5.5 | 28.0 | 18 | Anticosti Isl., G. of St. L | 29.60 |
| VII..... | 18 | 50 | 102 | 50 | 65 | 2.0 | 42.0 | 20 | Father Point, Quebec .. | 29.58 |
| VIII.... | 21 | 36 | 100 | 35 | 73 | 2.0 | 40.0 | 21 | Fort Elliott, Tex..... | 29.80 |
| IX..... | 23 | 47 | 107 | 43 | 71 | 5.0 | 24.0 | 27 | Harrisburg, Pa ..... | 29.52 |
| X..... | 27 | 52 | 121 | 54 | 95 | 2.5 | 22.0 | 27 | Calgary, N. W. T ..... | 29.34 |
| XI..... | 27 | 35 | 104 | 42 | 84 | 4.0 | 14.0 | 28,'9 | Fort Elliott, Tex ..... | 29.58 |
| XII..... | 30 | 34 | 105 | 30 | 99 | 1.0 | 25.0 | 30 | Fort Stanton, N. Mex .. | ?29.56 |
| Mean. | .... | 44 | 107 | 45 | 76 | 3.0 | 27.4 | .... | ..... | 29.56 |

TABLE II.

| Number. | Maximum abnormal fall in pressure in twelve hours. Amount. | Station. | Date. | Maximum abnormal rise in temperature in twelve hours. Amount. | Station. | Date. | Maximum wind velocity. Miles per hour. | Direction. | Date. |
|---|---|---|---|---|---|---|---|---|---|
| | Inch. | | | ° | | | | | |
| I..... | .34 | Yarmouth, N.S..... | 1 | 18 | Chatham, N. B ..... | 1 | 36 | sw. nw. | * |
| II.... | .38 | Qu'Appelle, N.W.T. | 1 | 26 | Bismarck, Dak..... | 1 | 56 | w. | 1 |
| III... | .38 | Qu'Appelle, N.W.T.. | 3 | 23 | La Crosse, Wis..... | 4 | 48 | e. | 7 |
| IV... | .34 | Calgary, N. W. T .... | 7 | 26 | Fort Buford, Dak .. 7 / Bismarck, Dak.... 8 | | 48 | w. | 7 |
| V.... | .18 | Washington, D. C.... | 12 | 22 | La Crosse, Wis..... | 11 | 76 | ne. | 14 |
| VI... | .30 | Anticosti I., G. St. L. | 18 | 20 | Minnedosa, N. W. T. | 14 | 38 | s. | 14 |
| VII.. | .44 | Rockliffe, Ont ..... | 19 | 26 | Sioux City, Iowa .... | 18 | 40 | nw. | 20 |
| VIII. | .22 | Santa Fé, N. Mex .... | 21 | 14 | Fort Elliott, Tex.... | 21 | 76 | n. | 24 |
| IX... | .36 | Wichita, Kans ..... 24 / Block Island, R. I.. 27 | | 15 | Wilmington, N. C... | 26 | 52 | e. | 29 |
| X.... | .40 | Calgary, N. W. T .... | 27 | 18 | Ft. Assiniboine, Mont | 27 | 40 | se. | 27 |
| XI... | .26 | Fort Elliott, Tex.... | 27 | 16 | Louisville, Ky..... | 30 | 48 | nw. | 28 |
| XII.. | .28 | El Paso, Tex ..... | 30 | 15 | Little Rock, Ark.... | 31 | 38 | se. | 31 |

*1st to 3d.

## NORTH ATLANTIC STORMS FOR OCTOBER, 1889 (pressure in inches and millimetres; wind-force by Beaufort scale).

The paths of the depressions that appeared over the north Atlantic Ocean during October, 1889, are shown on chart i. These paths have been determined from international simultaneous observations by captains of ocean steamships and sailing vessels received through the co-operation of the Hydrographic Office, Navy Department, and the "New York Herald Weather Service."

Nine depressions have been traced for October, 1889, the average number traced for the corresponding month of the last six years being 12.7. The greatest number of depressions traced for October was sixteen, in 1887, and the least number was seven, in 1883. Of the depressions traced for the current month three advanced eastward over, or north of, Newfoundland; three moved eastward from the coast south of New England; one advanced northeastward from the vicinity of western Cuba; one passed northwest from the Windward Islands, and recurved to the northeast near Bermuda; and one apparently originated west of the British Isles. Over the western portion of the ocean severe storms occurred on the 5th, when heavy gales were encountered north and northeast of Bermuda, attending the passage of the depression which had advanced from the Windward Islands; from the 13th to 16th, inclusive, gales of hurricane force were occasioned by a depression which pursued an irregular course off the middle Atlantic coast; and on the 23d and 24th storms of great violence attended a depression which passed off the south Atlantic coast during the 23d. The severest storms of the month over mid-ocean occurred on the 16–17th, when pressure falling below 29.00 (737), and strong to whole gales, attaining hurricane force on the 16th, were reported. Over and near the British Isles the barometer fell rapidly until the 7th, when the readings were below 28.70 (729) over Scotland. On this date a terrific gale prevailed throughout the British Isles. Many shipwrecks were reported and the coasts were strewn with wreckage. In the northern portions of England and Ireland many houses were demolished and numerous trees uprooted. During the 8th there was a decided increase in pressure over Great Britain, followed on the 9th by a marked decrease to below 28.80 (732), after which latter date the barometer continued relatively high until the 18th, when, under the influence of a storm advancing eastward over the Atlantic, there was a decided fall in pressure until the 20th, after which there was a gradual increase until the 24th, when the barometer was above 30.10 (764). On the 29th, 30th, and 31st, a depression over the ocean to the west and northwest caused south to west gales and low pressure over the British Isles. Reports at hand will not admit of definitely locating the tracks of the depressions that occasioned the severe storms over the British Isles during the first decade of the month; they seem to indicate, however, that on the 6th and 7th a depression passed north of Scotland, and on the 8th and 9th a depression moved east of south to the west coast of Scotland; was central north of Ireland on the 10th, and thence moving southeast disappeared east of Great Britain after the 12th.

The movements of areas of high pressure over the north Atlantic during the month were as follows: An extensive area of high pressure occupied the ocean between the tenth and sixty-fifth meridians and south of the fifteenth parallel on the 1st. This area remained over mid-ocean, alternately contracting and extending its longitudinal limits and gradually moving southward, until the 18th, when it disappeared south of the Azores. On this date an area of high pressure moved off the

middle Atlantic coast, and moved east and northeast until the 22d, when it occupied the ocean between the thirtieth and fiftieth meridians northward to the sixtieth parallel. On the date last named an area of high pressure appeared off the Atlantic coast south of New England and moved thence northeast to Newfoundland by the 24th and united with an area of high pressure over and near the Azores, and on the 25th and 26th the pressure was high from Newfoundland eastward over the British Isles. This area of high pressure contracted and moved southward to the Azores by the 29th, where it remained until the close of the month. During the 30th and 31st a small area of high pressure moved off the middle and south Atlantic coasts. Compared with the corresponding month of preceding years the storms over the north Atlantic during October, 1889, were deficient in number. The storms of the first decade over and near the British Isles, of the second and third decades off the coast of the United States, and of the second decade over mid-ocean, while failing to exhibit the extreme destructive violence of notable October storms of preceding years, were unusually severe, more especially those which prevailed over the British Isles from the 7th to 10th.

In October during the last sixteen years eight severe storms of tropical origin have advanced northward from the Caribbean Sea. In a majority of instances they have recurved over or near extreme western Cuba and the eastern part of the Gulf of Mexico and passed thence along or off the Atlantic sea-board to the vicinity of Newfoundland. In two instances only during this period, in 1886 and 1887, have storms of pronounced strength advanced from the Caribbean Sea over the Gulf of Mexico west of the ninetieth meridian in October. The following are brief descriptions of the more notable October storms of tropical origin traced and described in the MONTHLY WEATHER REVIEW for preceding years: 1873, 3d to 8th, a severe cyclone, first located south of western Cuba, recurved over the eastern Gulf; passed over Florida on the 6th, and continued its course northeastward off the Atlantic coast. Numerous disasters were caused at sea, and the settlement of Punta Rassa, Fla., was entirely destroyed, a hurricane velocity of ninety miles per hour being recorded at that place. Damage was also caused at Lake City, Saint Augustine, and Jacksonville, Fla., and at Charleston, S. C. 1876, 19th to 21st, storm first encountered by vessels in the Caribbean Sea south of Cuba. At Belen College Observatory, Havana, Cuba, the barometer reached its minimum, about 28.70 (729), at 11.45 a. m. of the 19th. The storm passed directly over Havana, and slightly to the east of Key West, Fla., where the lowest barometer, 28.73 (730), was noted at 8 p. m. of the 19th. The highest force of wind at Key West was at the rate of eighty-eight miles per hour at 8.45 p. m. of the 19th. The storm moved off the east-central coast of Florida on the morning of the 20th, and thence passed northeastward. 1877, September 21st to October 5th, storm moved from the Barbadoes westward over the Caribbean Sea and recurved between Cuba and Yucatan into the Gulf of Mexico, and by the night of October 2d had reached the coast of Florida near Saint Marks. Moving thence northeast the storm passed off the middle Atlantic coast, and was central south of Newfoundland on the night of the 5th. This storm caused immense damage to property and considerable loss of life in the West Indies, and during its passage over the continent was attended by very severe storms and destructive tides. 1878, 21st to 24th, storm moved from south of Cuba northward to the North Carolina coast, and thence to south-central New York, where it recurved eastward and passed over New England and south of Nova Scotia. A hurricane prevailed at Havana, Cuba, on the night of the 21st, with heavy rain, doing much damage to buildings and shipping. At Key West, Fla., the barometer fell to 29.53 (750), and the highest wind force was fifty-four miles per hour. At Kitty Hawk, N. C., the wind reached a velocity of eighty-eight miles per hour, and the barometer fell to 29.06 (738) on the 22d. The storm's vortex passed almost directly over Washington, D. C., where the lowest barometer, 28.80 (732), occurred about 7.15 a. m. of the 23d. The storm moderated somewhat in severity after recurving eastward over New England, but throughout its entire course over the continent was exceptionally severe, and ranks as one of the most destructive storms on record for the Atlantic coast. 1882, 8th to 10th, storm moved from south of Cuba to the east Gulf coast. Great loss of life and damage to property was reported in Cuba. The cyclone lost much of its energy after leaving Cuba. 1886, 8th to 12th, a very destructive storm moved from south of Cuba to the west Gulf coast, and dissipated over the west Gulf states. 1887, on the 11th a storm was central over the central Caribbean Sea, whence it moved to the west Gulf by the 17th; recurved to the Gulf coast near New Orleans, La.; thence moved to the south Atlantic states, skirted the middle Atlantic and New England coasts, and reached the Saint Lawrence Valley the night of the 23d, attended throughout by gales of great violence and general and heavy rain.

The following are brief descriptions of the depressions traced for October, 1889:

**1.**—This depression was central over or near the Windward Islands on the 1st and 2d, whence it moved northwest to about N. 28°, W. 68° by the 4th, where it recurved and passed west and north of Bermuda to the thirty-fifth parallel by the 5th, and on the morning of the 6th was central off the southern edge of the Banks of Newfoundland, after which it apparently dissipated. This depression exhibited greatest energy on the 5th, when strong to whole gales were encountered north and northeast of Bermuda.

**2.**—This depression was a continuation of low area i which passed over the Gulf of Saint Lawrence on the 2d, with pressure below 29.40 (747). By the 3d the centre of depression had moved northeast of Labrador beyond the region of observation.

**3.**—The presence of a barometric depression near western Cuba was indicated by reports of the 4th and 5th, and by the 6th the centre of disturbance had apparently advanced northeastward to north of the Bahamas, whence it moved rapidly northeast to the fortieth parallel by the 7th, and thence passed northward to the lower Saint Lawrence valley by the 8th. This depression augmented in energy until the 7th, when pressure below 29.60 (752) and fresh to strong gales were reported off the middle Atlantic and New England coasts. The northerly course of the storm after the morning of the 7th was apparently due to high barometric pressure to the east and northeast, the barometer over Newfoundland ranging to 30.47 (774) at Saint John's, giving a gradient of about .90 of an inch in about nine hundred miles on the morning of that date.

**4.**—This depression was apparently a continuation of low area iii which was central over the Saint Lawrence Valley and the Maritime Provinces from the 8th to 10th, inclusive, where it was apparently held by an area of high pressure overlying Newfoundland and the ocean to the eastward. With the giving away of this area of high pressure to the southeast and south the depression advanced eastward over northern Newfoundland during the 11th, whence it is traced irregularly eastward to the north of the British Isles, where it disappeared during the 16th, attended throughout by fresh to strong gales.

**5.**—This depression was a continuation of low area v, and on the 14th was central in about N. 39°, W. 72°, with pressure below 29.70 (754) and moderate to fresh gales. On this date a depression of small energy was central east of Bermuda. By the morning of the 15th depression number 5 had moved south to the thirty-sixth parallel and had apparently united with the depression central east of Bermuda on the preceding date, which had moved westward. On the 15th a marked decrease in central pressure was shown and gales of hurricane force were reported off the middle Atlantic coast. During the next twenty-four hours the centre of disturbance moved southward to the thirty-fourth parallel, with pressure below 29.50 (749) and gales of hurricane force, after which it moved rapidly east-northeast and probably united after the 19th with an extensive area of low pressure central over the British Isles.

**6.**—This depression moved eastward from north of New-

foundland, where it was central on the 15th, to the British Isles by the 19th, in which region it continued until after the 22d. The depression was attended by severe storms, and on the 17th pressure falling below 29.00 (737) was reported.

**7.**—This depression was a continuation of low area viii which passed off the south Atlantic coast during the 23d. On the 24th the storm was central about midway between Bermuda and the south Atlantic coast, with central pressure below 29.70 (754) and fresh to strong gales. Passing thence northeastward, attended by strong gales, the depression dissipated over or near the Banks of Newfoundland after the 26th.

**8.**—This depression was a continuation of low area ix which advanced eastward from the New England coast during the 28th, and passed thence eastward to the sixty-fifth meridian by the 29th, whence it moved northward to the vicinity of the west coast of Newfoundland, where it remained as an area of low pressure to the close of the month.

**9.**—This depression apparently developed west of the British Isles, and on the 28th was central in about N. 55°, W. 24°, with pressure below 29.60 (752) and moderate to fresh gales. Moving slightly northwest by the 29th the storm passed northeastward during the 30th, and by the 31st had disappeared north of the region of observation, with a decided decrease in pressure and a marked increase in energy.

### OCEAN ICE IN OCTOBER.

The following table shows the southern and eastern limits of the region within which icebergs or field ice were reported for October, during the last seven years:

| Southern limit. | | | Eastern limit. | | |
|---|---|---|---|---|---|
| Month. | Lat. N. | Long. W. | Month. | Lat. N. | Long. W. |
| | ° ′ | ° ′ | | ° ′ | ° ′ |
| October, 1883 | 46 56 | 46 22 | October, 1883 | 46 56 | 46 22 |
| October, 1884 | Off Cape | Race. | October, 1884 | 46 56 | 50 55 |
| October, 1885 | 48 21 | 47 12 | October, 1885 | 48 21 | 47 12 |
| October, 1886 | 41 34 | 49 43 | October, 1886 | 46 03 | 46 37 |
| October, 1887 | 42 58 | 50 02 | October, 1887 | 42 58 | 50 02 |
| October, 1888 | 51 43 | 55 36 | October, 1885 | 51 43 | 55 36 |
| October, 1889 | 44 32 | 49 28 | October, 1889 | 46 30 | 45 59 |

In October, 1889, the southernmost ice reported, a large iceberg observed on the 14th in the position given, was about two degrees south of the average southern limit, and the easternmost ice reported, a large iceberg, was over three degrees east of the average eastern limit of ice for the month. Ice was most frequently observed from Belle Isle eastward to the fifty-second meridian; it was also frequently encountered along the east and northeast edges of the Banks of Newfoundland. No ice was reported near the coast of Newfoundland south of the fiftieth parallel. Compared with the corresponding month of last six years the amount of Arctic ice reported for October, 1889, was largely in excess of the average quantity, and the region of its prevalence was considerably extended.

The following positions of icebergs and field ice reported are shown on chart i by ruled shading:

1st.—N. 47° 28′, W. 47° 00′, a medium sized berg; N. 46° 57′, W. 47° 24′, a large berg about one hundred and twenty feet high.

2d.—N. 46° 30′, W. 45° 59′, a large berg with pyramid bluff at each end.

3d.—N. 52° 18′, W. 53° 20′ to N. 52° 05′, W. 53° 56′, two large bergs; N. 46° 40′, W. 47° 04′, four lumps of ice.

4th.—N. 52° 19′, W. 52° 35′, a large berg; N. 47° 02′, W. 46° 11′, a large berg.

5th.—N. 50° 03′, W. 56° 40′, a large berg.

6th.—N. 45° 47′, W. 48° 41′, a large berg.

10th.—Point Amour to Cape Norman, several bergs; also off Belle Isle, several bergs.

11th.—Off Cape Norman, several small bergs; N. 52° 30′, W. 52° 30′, several large bergs from Belle Isle to this position.

12–13th.—N. 52° 20′, W. 52° 30′, a small berg; N. 52° 05′, W. 53° 46′, two medium sized bergs; in the straits of Belle Isle, a small berg.

14th.—N. 44° 32′, W. 49° 28′, a large iceberg; N. 52° 50′, W. 52° 30′, two bergs; also five bergs, about twenty miles apart, between the above position and Belle Isle; off Greenley Island, small bergs.

15th.—N. 52° 40′, W. 51° 30′, one large berg, and a quantity of small pieces.

16th.—N. 45° 14′, W. 49° 08′, a berg; N. 52° 39′, W. 52° 45′, a large berg; off Cape Onion, N. F., a large berg; N. 52° 50′, W. 52° 14′; two large bergs.

17th.—From N. 51° 58′, W. 55° to Point Amour, several large and small bergs.

17–19th.—N. 52° 24′, W. 52° 51′, a small berg; N. 51° 56′, W. 54° 36′, a large berg; two bergs in Straits of Belle Isle; one off Cape Banco, the other off Cape Norman.

21st.—N. 51° 56′, W. 53° 42′, one large berg; eight miles east of Belle Isle, very large berg, also several smaller ones.

22d.—N. 48° 05′, W. 50° 07′; one irregular, oblong-shaped berg, about one hundred yards long and forty feet high.

23d.—Ninety miles east of Belle Isle, one large berg; also several small bergs; N. 46° 44′, W. 47° 21′, one berg, four hundred feet long and one hundred feet high.

24th.—N. 47° 46′, W. 48° 12′, one large berg.

26th.—N. 52° 25′, W. 52° 00′, one medium sized berg; N 52° 00′, W. 54° 30′, one berg.

29th.—Off Point Amour, two small bergs; also off Belle Isle three small bergs.

### FOG IN OCTOBER.

The following are limits of fog-areas on the north Atlantic Ocean, west of the fortieth meridian, for October, 1889, as reported by shipmasters:

| Date. | Entered. | | Cleared. | | Date. | Entered. | | Cleared. | |
|---|---|---|---|---|---|---|---|---|---|
| | Lat. N. | Lon. W. | Lat. N. | Lon. W. | | Lat. N. | Lon. W. | Lat. N. | Lon. W. |
| | ° ′ | ° ′ | ° ′ | ° ′ | | ° ′ | ° ′ | ° ′ | ° ′ |
| 3 | 43 42 | 49 24 | 43 51 | 48 46 | 11 | 44 51 | 49 33 | 45 01 | 48 34 |
| 3 | 43 19 | 51 16 | 43 24 | 50 44 | 15–16 | 44 00 | 49 10 | 45 05 | 47 05 |
| 3 | 46 31 | 45 33 | 45 15 | 48 33 | 15–16 | 43 38 | 53 51 | 43 55 | 51 52 |
| 4 | 45 57 | 52 51 | 45 12 | 54 30 | 19 | 47 44 | 45 00 | 46 55 | 47 55 |
| 4–5 | 44 45 | 52 35 | 46 15 | 46 43 | 21 | 41 36 | 64 12 | 41 34 | 64 24 |
| 5 | 47 49 | 44 45 | 46 09 | 49 24 | 22 | 45 02 | 50 46 | 44 54 | 51 26 |
| 5 | 44 05 | 49 00 | 43 54 | 50 02 | 22 | 48 02 | 48 00 | 47 06 | 49 06 |
| 5 | 44 16 | 48 38 | 44 27 | 47 50 | 23 | 46 29 | 47 10 | 46 22 | 47 28 |
| 5 | 47 55 | 47 32 | 48 09 | 48 52 | 25–26 | 42 06 | 65 12 | 41 19 | 67 15 |
| 8 | 45 38 | 50 42 | 44 46 | 54 02 | 26 | 45 32 | 58 44 | 45 04 | 61 00 |
| 9 | 46 25 | 47 00 | 45 20 | 51 54 | 26 | 42 49 | 62 24 | 43 03 | 64 29 |
| 9 | 44 39 | 55 46 | 43 27 | 59 23 | 26 | 41 32 | 65 58 | 41 20 | 66 29 |
| 9–10 | 47 20 | 43 04 | 45 00 | 50 22 | 26 | 41 40 | 68 00 | 40 56 | 67 30 |
| 9–10 | 47 27 | 42 54 | 46 09 | 48 44 | 26–27 | 46 38 | 52 17 | 44 13 | 55 55 |
| 10 | 47 34 | 46 20 | 47 18 | 47 02 | 26–27 | 47 38 | 52 27 | 46 21 | 54 15 |
| 10 | 43 47 | 50 33 | 44 14 | 48 21 | 27 | 47 01 | 44 15 | 46 44 | 45 33 |
| 11 | 45 35 | 47 19 | 45 19 | 48 37 | 28–29 | 42 52 | 66 37 | 43 00 | 67 00 |
| 11 | 51 34 | 56 30 | off Cape Norman. | | 30 | 43 23 | 50 55 | 43 18 | 51 20 |

The limits of fog-belts west of the fortieth meridian are shown on chart i by dotted shading. In the vicinity of the Banks of Newfoundland fog was reported on fifteen dates; between the fifty-fifth and sixty-fifth meridians on four dates; and west of the sixty-fifth meridian on four dates. Compared with the corresponding month of the last two years the dates of occurrence of fog near Newfoundland were three in excess of the average; between the fifty-fifth and sixty-fifth meridians one less than the average; and west of the sixty-fifth meridian one more than the average. Over and near the Grand Banks fog was reported with the advance of areas of low pressure from the westward, except on the 22d and 23d, when variable winds and rain prevailed in that region. Between the fifty-fifth and sixty-fifth meridians fog was reported on the 9th, with an area of low pressure central in the Saint Lawrence Valley; on the 21st with variable winds and rain; on the 26th with an area of low pressure central southeast of Nova Scotia, and another on the south Atlantic coast; and on the 27th with an area of low pressure moving northeastward along the south and middle Atlantic coasts. West of the sixty-fifth meridian fog was reported on the 25th with an area of low pressure central north of Bermuda; on the 26th with an area of low pressure central southeast of Nova Scotia,

and another area of low pressure on the south Atlantic coast; on the 28th with an area of low pressure central over New England; and on the 29th with an area of low pressure central southeast of Nova Scotia.

## TEMPERATURE OF THE AIR (expressed in degrees, Fahrenheit).

The distribution of mean temperature over the United States and Canada for October, 1889, is exhibited on chart ii by dotted isotherms. In the table of miscellaneous meteorological data the monthly mean temperature and the departure from the normal are given for regular stations of the Signal Service. The figures opposite the names of the geographical districts in the columns for mean temperature and departure from the normal show, respectively, the averages for the several districts. The normal for any district may be found by adding the departure to the current mean when the departure is below the normal and subtracting when above. The monthly mean temperature for regular stations of the Signal Service represents the mean of the maximum and minimum temperatures.

In October, 1889, the mean temperature was highest in extreme southeastern California and southwestern Arizona, the lower Rio Grande valley, and extreme southern Florida, where it was above 75°, the highest mean reading, 84°.5, being reported at Fort Brown, Tex. The mean values were above 65° south of a line traced irregularly westward from the Georgia coast to southeastern Arizona, thence northwestward over the San Joaquin Valley, and thence east of south to the California coast near Los Angeles. The lowest mean temperature was reported north of a line traced from Manitoba east-southeast to west-central Quebec, and in central Colorado, where it fell below 35°, the lowest means reported being 28°.8, at Dolly Varden Mines, Colo., and 33°.2, at Atlantic, Mich. The mean readings were generally below 50° north of a line traced from the southern coast of New England southwestward to western Virginia, thence northwestward to central Dakota, thence west-southwest to south-central New Mexico, and thence irregularly northwestward to Puget Sound, over western portions of the middle plateau region, and in south-central Oregon.

The reports of regular stations of the Signal Service show that the mean temperature for October, 1889, was below the normal east of the Rocky Mountains, except in Dakota, in Texas west of the ninety-eighth meridian, and at coast stations in New Brunswick and southeastern Nova Scotia. In the Rocky Mountain and plateau regions and on the Pacific coast the month was warmer than the average October. The greatest departures below the normal temperature occurred from the middle Atlantic and North Carolina coasts northward over the Lake region, where they exceeded 5°, and the most marked departures above the normal were noted in the northern plateau region and on the northeastern slope of the Rocky Mountains, where they were more than 5°. Considered by districts the average departure below the normal temperature was 6°.3 in the lower lake region; 5°.3 in the middle Atlantic states; 4°.9 in the Ohio Valley and Tennessee; 4°.6 in the upper lake region; 4°.0 in the south Atlantic states and the upper Mississippi valley; 3°.3 in New England; 3°.2 in the Florida Peninsula and the east Gulf states; 1°.4 in the west Gulf states; and 0°.4 in the Missouri Valley. The average departure above the normal temperature was 6°.1 in the northern plateau region; 4°.4 on the northeastern slope of the Rocky Mountains; 3°.4 on the south Pacific coast; 3°.3 on the north Pacific coast; 2°.4 in the extreme northwest and the middle plateau region; 1°.8 in the southern plateau region; 0°.8 on the southeastern slope of the Rocky Mountains; and 0°.6 on the middle Pacific coast. On the middle-eastern slope of the Rocky Mountains and in the Rio Grande Valley the mean temperature averaged normal.

The following are some of the most marked departures from the normal at the older established Signal Service stations:

| Above normal. | ° | Below normal. | ° |
|---|---|---|---|
| Fort Maginnis, Mont. | 7.2 | Erie, Pa. | 7.8 |
| Medicine Hat, N. W. T. | 7.0 | Rochester, N. Y. | 7.1 |
| Spokane Falls, Wash. | 6.4 | Cape Henry, Va. | 6.6 |
| Portland, Oregon | 4.2 | Cincinnati, Ohio | 6.4 |
| San Diego, Cal. | 3.4 | Saugeen, Ont. | 6.0 |

### DEVIATIONS FROM NORMAL TEMPERATURES.

The following table shows for certain stations, as reported by voluntary observers, (1) the normal temperature for a series of years; (2) the length of record during which the observations have been taken, and from which the normal has been computed; (3) the mean temperature for October, 1889; (4) the departure of the current month from the normal; (5) and the extreme monthly means for October, during the period of observation and the years of occurrence:

| State and station. | County. | (1) Normal for the month of Oct. | (2) Length of record. | (3) Mean for Oct., 1889. | (4) Departure from normal. | (5) Extreme monthly mean temperature for Oct. | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Highest. | Year. | Lowest. | Year. |
| *Arkansas.* | | ° | *Years* | ° | ° | ° | | ° | |
| Lead Hill | Boone | 60.2 | 8 | 59.2 | −1.0 | 64.0 | 1881 | 56.0 | 1885 |
| *California.* | | | | | | | | | |
| Sacramento | Sacramento | 61.9 | 36 | 55.6 | −6.3 | 69.9 | 1875 | 54.8 | 1886 |
| *Colorado.* | | | | | | | | | |
| Fort Lyon | Bent | 58.0 | 19 | 53.8 | −4.2 | 57.8 | 1871 | 42.2 | 1867 |
| *Connecticut.* | | | | | | | | | |
| Middletown | Middlesex | 50.1 | 22 | 47.2 | −2.9 | 54.7 | 1871 | 45.5 | 1888 |
| *Florida.* | | | | | | | | | |
| Merritt's Island | Brevard | 74.9 | 5 | 73.8 | −1.1 | 76.2 | 1884 | 73.1 | 1885 |
| *Georgia.* | | | | | | | | | |
| Forsyth | Monroe | 67.4 | 15 | 65.7 | −1.7 | 75.4 | 1884 | 61.7 | 1885 |
| *Illinois.* | | | | | | | | | |
| Peoria | Peoria | 54.0 | 30 | 50.2 | −3.8 | 62.7 | 1879 | 45.2 | 1869 |
| Riley | McHenry | 47.5 | 33 | 45.7 | −1.8 | 56.0 | 1879 | 38.6 | 1869 |
| *Indiana.* | | | | | | | | | |
| Vevay | Switzerland | 56.1 | 23 | 51.6 | −4.5 | 65.0 | 1879 | 43.2 | 1869 |
| *Iowa.* | | | | | | | | | |
| Cresco | Howard | 46.0 | 17 | 43.0 | −3.0 | 54.1 | 1879 | 41.2 | 1873 |
| Monticello | Jones | 49.1 | 34 | 44.7 | −4.4 | 58.0 | 1879 | 36.0 | 1873 |
| Logan | Harrison | 52.6 | 15 | 52.3 | −0.3 | 60.7 | 1879 | 48.5 | 1875 |
| *Kansas.* | | | | | | | | | |
| Lawrence | Douglas | 54.4 | 21 | 53.6 | −0.8 | 60.5 | 1879 | 44.0 | 1869 |
| Wellington | Sumner | 56.6 | 10 | ..... | ..... | 60.6 | 1879, '84 | 53.3 | 1880, '83 |
| *Louisiana.* | | | | | | | | | |
| Grand Coteau | Saint Landry | 68.8 | 8 | 67.6 | −1.2 | 75.5 | 1883 | 64.8 | 1885 |
| *Maine.* | | | | | | | | | |
| Gardiner | Kennebec | 47.2 | 49 | ..... | ..... | 52.4 | 1879 | 43.1 | 1859 |
| *Maryland.* | | | | | | | | | |
| Cumberland | Allegany | 50.8 | 30 | 49.5 | −1.3 | 60.0 | 1881 | 41.8 | 1869 |
| *Massachusetts.* | | | | | | | | | |
| Amherst | Hampshire | 48.8 | 53 | 48.2 | −0.6 | 56.0 | 1879 | 42.8 | 1841 |
| Newburyport | Essex | 49.6 | 11 | 46.9 | −2.7 | 55.0 | 1879 | 45.1 | 1888 |
| Somerset | Bristol | 52.6 | 17 | 50.9 | −1.7 | 58.1 | 1879 | 47.6 | 1874 |
| *Michigan.* | | | | | | | | | |
| Kalamazoo | Kalamazoo | 50.0 | 13 | 46.8 | −3.2 | 54.5 | 1879 | 45.7 | 1887 |
| Thornville | Lapeer | 50.8 | 12 | 45.6 | −5.2 | 58.5 | 1879 | 45.6 | 1889 |
| *Minnesota.* | | | | | | | | | |
| Minneapolis | Hennepin | 45.4 | 24 | 43.8 | −1.6 | 56.1 | 1879 | 36.5 | 1869 |
| *Montana.* | | | | | | | | | |
| Fort Shaw | Lewis & Clarke | 48.9 | 20 | 51.2 | +2.3 | 58.1 | 1879 | 34.6 | 1881 |
| *New Hampshire.* | | | | | | | | | |
| Hanover | Grafton | 44.9 | 54 | 42.4 | −2.5 | 52.4 | 1879 | 38.6 | 1836 |
| *New Jersey.* | | | | | | | | | |
| Moorestown | Burlington | 53.5 | 26 | 49.8 | −3.7 | 59.5 | 1879 | 48.6 | 1888 |
| South Orange | Essex | 53.0 | 19 | 48.4 | −4.6 | 58.1 | 1879 | 47.2 | 1871 |
| *New York.* | | | | | | | | | |
| Cooperstown | Otsego | 46.5 | 35 | 41.6 | −4.9 | 53.3 | 1879 | 40.7 | 1865 |
| Palermo | Oswego | 47.2 | 35 | 41.8 | −5.4 | 53.9 | 1879 | 41.8 | 1889 |
| *North Carolina.* | | | | | | | | | |
| Lenoir | Caldwell | 56.8 | 18 | 54.0 | −2.8 | 66.4 | 1878 | 48.0 | 1874 |
| *Ohio.* | | | | | | | | | |
| N'th Lewisburgh | Champaign | 52.0 | 57 | 48.6 | −3.4 | 58.0 | 1852 | 43.0 | 1869 |
| Wauseon | Fulton | 50.7 | 19 | 45.2 | −5.5 | 59.0 | 1879 | 45.2 | 1889 |
| *Oregon.* | | | | | | | | | |
| Albany | Linn | 51.9 | 9 | 54.4 | +2.5 | 56.3 | 1885 | 48.7 | 1881 |
| Eola | Polk | 51.4 | 18 | 54.9 | +3.5 | 59.7 | 1876 | 45.4 | 1873 |
| *Pennsylvania.* | | | | | | | | | |
| Dyberry | Wayne | 46.7 | 21 | 41.6 | −5.1 | 53.4 | 1879 | 41.2 | 1869 |
| Grampian Hills | Clearfield | 47.8 | 25 | 45.1 | −2.7 | 56.4 | 1879 | 39.2 | 1869 |
| *South Carolina.* | | | | | | | | | |
| Statesburgh | Sumter | 64.0 | 8 | 60.4 | −3.6 | 69.0 | 1881 | 59.8 | 1885, '88 |